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INTEROPERABILITY AND A STANDARD JOINT LOGISTICS DATA EXCHANGE WITHIN THE DEPARTMENT OF DEFENSE

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ABSTRACT

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As the Department of Defense (DoD) continues to transform into a more efficient and coordinated fighting force, the elements of logistics support will continue to become more complex and will require more efficient ways of communication. The component Services currently have a myriad of logistics systems available to support their individual Service members. Many of these systems are not interoperable even within the same Service. The DoD has initiated the development of the Global Combat Support System (GCSS) to expand logistical information to operational levels. In recent years, private industry has been using the eXtensible Mark-up Language (XML) to promote interoperability among related industry partners via common or standard XML based data exchanges. The Defense Information Systems Agency (DISA) has also recently stood up the XML registry for the Defense Information Infrastructure (DII) Common Operating Environment (COE). The development of this registry provides a platform for enabling the standardization of DoD logistics data elements. If the DoD could develop a standard XML based data exchange for logistics support, all of those systems that are currently in use could be mapped to the new standard exchange to provide an exchange of information between computer systems that currently do not have that capability. The standard logistics data definitions within GCSS could be used as a starting point to augment existing data element definitions in the DISA XML registry. By cross-referencing and augmenting the existing logistics data definitions in the DISA XML registry with the standard definitions within GCSS, the DoD could begin to manage the myriad of logistics data definitions and move forward in developing a standard joint logistics data exchange. This paper will explore the previous attempts to standardize DoD logistics data and the possibility of developing a standard XML based data exchange for Joint Logistics Information, the problems associated with this process and what the subsequent benefits will be.

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PREFACE

For want of a nail, the shoe was lost;
For want of the shoe, the horse was lost;
For want of the horse, the rider was lost;
For want of the rider, the battle was lost;
For want of the battle, the kingdom was lost,
And all for the want of a nail.
— Author Unknown

Many people within the Department of Defense (DoD) logistics data management community have long realized the need to be able to exchange information between various logistics support functions. The DoD logistics support processes allow the United States component Services to keep US forces maintained in a high state of readiness throughout the world. As the DoD logistics information systems become more integrated and able to share information more readily, they will help improve the readiness of combined forces while reducing the costs associated with maintaining readiness.

Historically, the DoD has not been very good at integrating information either within individual Services or between the four Services. During Operation Desert Shield/Desert Storm, the logistics philosophy was to mass as much supply and repair materials as possible within the area of operations in order to maintain the fighting forces in Saudi Arabia. The speed and operational tempo envisioned for future combat systems of tomorrow will not afford future logistics systems the luxury of having large amounts of time to mass the materials that might be needed to sustain battlefield operations. The future logistics processes will need to work smarter and faster with much less mass and higher velocities of material-flow in order to have the right material at the right place and at the right time.

In recent years, improvements in the ways computer systems share information have allowed the Services to collect more accurate and timely data concerning asset availability, repair status, in-transit visibility and delivery status. Much more needs to be done to allow the Services to assimilate and transform this data into knowledge that can be used to make sure that deployed combatant forces receive the best support available through combined logistics support processes. Fighting forces of the United States should never be put in the position of facing defeat for want or need of logistical support.

LIST OF ILLUSTRATIONS

INTEROPERABILITY AND A STANDARD JOINT LOGISTICS DATA EXCHANGE WITHIN THE DEPARTMENT OF DEFENSE

The description of "Focused Logistics" that the Joint Staff has provided in Joint Vision 2020 is "the ability to provide the joint force the right personnel, equipment and supplies in the right place, at the right time and in the right quantity, across the full range of military operations."[1] This vision provides a starting point for the Department of Defense (DoD) logisticians to develop capabilities that will enable this vision to become a reality. The ability to deliver a transformed logistics process based on this vision is in part determined by the technology available to gather, assimilate and categorize the data, identify the context in which it must be used and transform this data into knowledge that logisticians at both strategic and operational levels can use. Advances in Internet technology, such as the development of business process data exchanges can be leveraged to enable the knowledge transformation processes within the DoD.

Business process data exchanges are currently being used throughout private industry to enable the sharing of information between business partners. The standard logistics data definitions within the Global Combat Support System (GCSS) could be used as a starting point to augment existing data element definitions. By cross-referencing and augmenting the existing logistics data definitions in a DoD registry with the standard definitions within GCSS, the DoD could begin to manage the myriad of logistics data definitions and move forward in developing a standard joint logistics data exchange. This paper will explore the previous attempts to standardize DoD logistics data, the possibility of developing a standard eXtensible Mark-up Language (XML) based data exchange for Joint Logistics Information, the problems associated with this process and the subsequent benefits of a logistics data exchange.

Under direction of the Deputy Under Secretary of Defense for Logistics and Materiel Readiness DUSD(LM&R), the Joint Logistics Board (JLB) developed a white-paper that highlighted six integrated and collaborative initiatives as elements of a document entitled the Future Logistics Enterprise (FLE). These initiatives were intended to identify ways to accelerate DoD's implementation of integrated logistics. The sixth initiative of the FLE document is Enterprise Integration (EI). Identifying common functions between the Services allows the EI initiative to reuse specific business process software modules. The reuse of common business processes could help avoid additional software and interface changes between the Services' automated logistics systems. The JLB "estimates that between $1.5B and $2.5B is spent annually to support thousands of logistics systems and their associated interfaces across the

DoD."[2] It is no longer feasible for the DoD to continue maintaining this myriad of system interfaces at very high costs. It is the intent of the EI initiative to provide logisticians access to "actionable information provided by modern, commercially-based software products that have been rapidly implemented to reengineered logistics processes and business rules."[3]

The development of a standardized DoD logistics data exchange would allow the military Services to reengineer their logistics processes and business rules in increments. Most successful reengineering processes are completed in small manageable increments or continuous cycles of improvement via pilot programs. In 1996 a U.S. General Accounting office report on reengineering the Air Force's logistics system reported that "using the pilot program approach shortens the implementation time,"[4] resulting in more efficient processes. More efficient processes coupled with cultural change and continuous improvements can stimulate further reductions in logistics inventories, resulting in greater cost savings.

As the DoD works to accelerate the implementation of integrated logistics through the six collaborative initiatives, the individual Services must identify any obstacles that must be overcome to achieve this goal. "The corporate culture within DoD … has been traditionally resistant to change and must become receptive to radical new concepts of operations."[5] In addition to the issues associated with the six collaborative initiatives identified by DUSD(LM&R), there are many other roadblocks that can keep the vision of Focused Logistics from happening. History shows that the DoD has been wrestling with the problems of systems interoperability and data standards for many years.

BACKGROUND ON DOD LOGISTICS STANDARDIZATION PROCESSES

Logisticians across DoD's component Services must be able to share information at all levels of command. Not only must information be available for sharing, but it also must be actionable data that can be used to solve problems such as moving material, locating spare parts, identifying critical repair information or processes and accurately predicting equipment failures. From one Service to the next the data to support logistics processes is often defined differently both in terms of the context and data fields used to describe the information being processed. The ideal scenario to promote interoperability among DoD's Service specific systems would be for all Services to adhere to a standard set of data definitions for all of their logistics processes. The DoD has sponsored many efforts to standardize logistics data. Many of the products that resulted from DoD standardization efforts could be used in the development of an XML based data exchange for joint logistics information processes.

MILS AND DLSS

As the DoD began automating its logistics systems in the early 1960s, logistics leaders realized that they would need to identify standard transactions for various transaction processes. Through the efforts of the Defense Logistics Management Standards Office (DLMSO) the DoD began to develop interoperability standards via the "Military Standard Logistics Systems (MILS)" [6] transactions to move logistics data through the Defense Logistics Standard System (DLSS). This enabled the automated movement of information from one Military Service system to another. The standard MILS transactions were based upon the standard input media of the day, the eighty-character punched card. The punched cards provided eighty characters to identify the transaction type and all of the associated information that needed to be processed with that transaction.

Examples of the many types of eighty character transaction sets are the "Military Standard Requisitioning and Issue Procedures (MILSTRIP), Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP), Military Supply and Transportation Evaluation Procedures (MILSTEP) and Military Standard Billing System (MILSBILLS)."[7] These standard transaction types were used to allow the different Services to exchange information with each other and DLA. The eighty-character card MILS transactions served the DoD well throughout the 70s and into the 80s. However, the format limit of eighty characters per card made it difficult to expand the amount of information and capabilities of the systems using them. The Defense Logistics Agency's (DLA's) Defense Automated Addressing System Center (DAASC) was processing MILS transactions at a rate of several hundred million transactions a year and currently "approximately one billion transactions are transmitted annually."[8] The DAASC managed the processing of MILS transactions and began efforts to expand the size of the MILS transactions in order to take advantage of advances in information technology development efforts.

DEN DICTIONARY

In addition to developing standard transaction formats the DLMSO also began working with military Service representatives to standardize data elements to be used in the standard MILS transactions. A data element identifies attributes that are either an input or output of an automated process. The data element description identifies how the data is used, the number of characters used to describe the data and any restrictions on its use, i.e. numeric, alpha or combinations thereof. Standard data element names (DENs) were assigned to each data element and the data elements along with their assigned DEN numbers and descriptions were coordinated with each Service and recorded in the Standard DEN Dictionary. The DoD

developed standard MILS transactions containing DEN information for financial, item cataloging, requisitioning, procurement, repair, contracting and asset reporting processes.

DEFENSE AUTOMATED ADDRESSING SYSTEM CENTER

The DAASC has developed standard automated cross reference interpreters for MILS, Electronic Data Interchange (EDI) and XML based transactions to enhance DoD logistics processes. The DAASC has automated standard transaction reference tables built into their transaction process. The tables enable the DAASC system to process MILS, EDI and XML transactions interchangeably. Soon after the Defense Logistics Agency was tasked to consolidate wholesale logistics processes for all DoD consumable items, it was recognized that the DoD also needed to expand the amount of data that could be transmitted by the MILS transaction sets. "DRID#48 established a DoD EDI integrated product team and directed all DoD logistics components to begin adopting commercial EDI standards."[9] The DoD began working with industry partners to develop variable length electronic data interchange (EDI) transactions for the various logistics processes. DAASC then incorporated these EDI transactions into its system processes and automatically performed conversions between the EDI and MILS transactions.

EDI STANDARDS

Electronic Data Interchange (EDI) was established as a technology for processing computer-based transactions between two business partners. The EDI standards development process was very similar to the development of the DoD MILS standards except that this effort recognized the need to expand beyond the eighty character restrictions imposed by the punched cards used for MILS. The efforts of commercial standards organizations to develop standards for electronic commerce and electronic data interchange, such as the United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) standards, continue to aid the exchange of data within commercial industries. Usually the standards developed do not cover all aspects of data that are required to be shared within the DoD logistics support processes. EDI transaction processing was not well received by some of DoD's small commercial vendors because of the high cost of implementing EDI transaction processes. "Implementing traditional EDI requires a significant investment of time and money for developing and maintaining agreed-upon inter- and intra-industry standards and trading-partner-specific implementing conventions for those generic standards."[10] The DoD processes could be realigned to make use of all EDI transactions that currently exist. However, there are some unique operational support processes within DoD that must be accommodated within the

EDI transactions, or the DoD will need to supplement the existing transaction sets with uniquely DoD transactions.

CIM AND THE JOINT LOGISTICS SYSTEMS CENTER

The DoD Corporate Information Management (CIM) initiative goals were to improve the standardization, quality and consistency of data from DoD's many information management systems and to reduce the duplicative functional systems across the DoD. The CIM effort for logistics processes began reviewing existing DoD logistics systems in order to identify the best systems to be used as standardized processes across all DoD military Services. The DoD Joint Logistics Systems Center (JLSC) was stood up to manage the DoD Logistics CIM efforts. As part of the standard systems development efforts at the JLSC, all of the military Services participated in an effort to identify all data and processes associated with the logistics processes of materiel management and depot maintenance. "Created as a showcase for DoD's Corporate Information Management initiative, JLSC was supposed to replace hundreds of legacy systems used by the Services with a single family of standard applications."[11] Although many of the standard systems developed at the JLSC were never fully implemented across all of DoD, some systems were successfully implemented and the standard data and process models developed during that timeframe have been used successfully to identify common data and processes across the DoD military Services.

CALS STANDARDS

The Computer-aided Acquisition and Logistics Support (CALS) initiative developed standards for data exchange and supported many initiatives for paperless processing of business transactions. The CALS efforts encouraged DoD project managers and procurement personnel to begin buying digital data rather than hard copy engineering drawings and technical manuals in support of new weapon systems. The DoD CALS program offices also tackled the difficult task of digitizing the millions of existing engineering drawings and technical manuals into standard formats that could be used for repair support and re-procurement efforts. DoD suppliers were affected by CALS standards imposed for processing engineering and technical data. Some of those effects were positive since the standards imposed were also adopted by private industry and could be used for other industry processes.

CALS addressed issues with the timely and efficient handling of information that supported weapons and commercial products acquired by the DoD. The whole idea of CALS was to improve productivity within DoD as well as reduce the paperwork required from supporting vendors and suppliers. The CALS efforts developed methods and standards for

electronic transmission of engineering drawings, technical manuals and manufacturing documentation. Many logisticians realized that the standards they were establishing for logistics processes needed to be adopted by the acquisition world so that any electronic media that was purchased in support of major weapon systems would be compatible with the logistics processes. The concept of CALS migrated to the Continuous Acquisition and Life-Cycle Support/Electronic Data Interchange (CALS/EDI) concept that allowed standards proponents to work more closely with acquisition offices to standardize technical support data required for acquisition transactions and life cycle support of weapon systems.

THE DEFENSE REFORM INITIATIVE DIRECTIVE (DRID) #54 AND LOGISTICS TRANSFORMATION

Although the DoD has expended vast resources for the purpose of standardizing logistics data and its processes, there currently exist many logistics systems and processes that do not use standard data or processes. DRID #54 recognized the need to transform DoD logistics processes so that they could be made more interoperable and react with greater precision and reliability. "The DRID #54 required the military Services, TRANSCOM, and the Defense Logistics Agency (DLA) to submit logistics transformation implementation plans to be reviewed for consistency with the DoD Logistics Strategic Plan objectives and Joint Staff's Joint Vision 2010." [12]

Future logistics systems will be built in part by reengineering legacy systems that will be required to operate in a network centric, information centric and real-time web-based environment. Traditional logistics business processes will need to change. As a result of this focus, the Joint Chiefs of Staff, Director for Logistics (J-4) and the Deputy under Secretary of Defense (Logistics) have partnered with the Services, Combatant Commanders and the Defense Agencies to begin establishing this new environment. Figure 1 outlines the DRID #54 goals of the 23 March 2000 "Logistics Transformation Plans." [13]

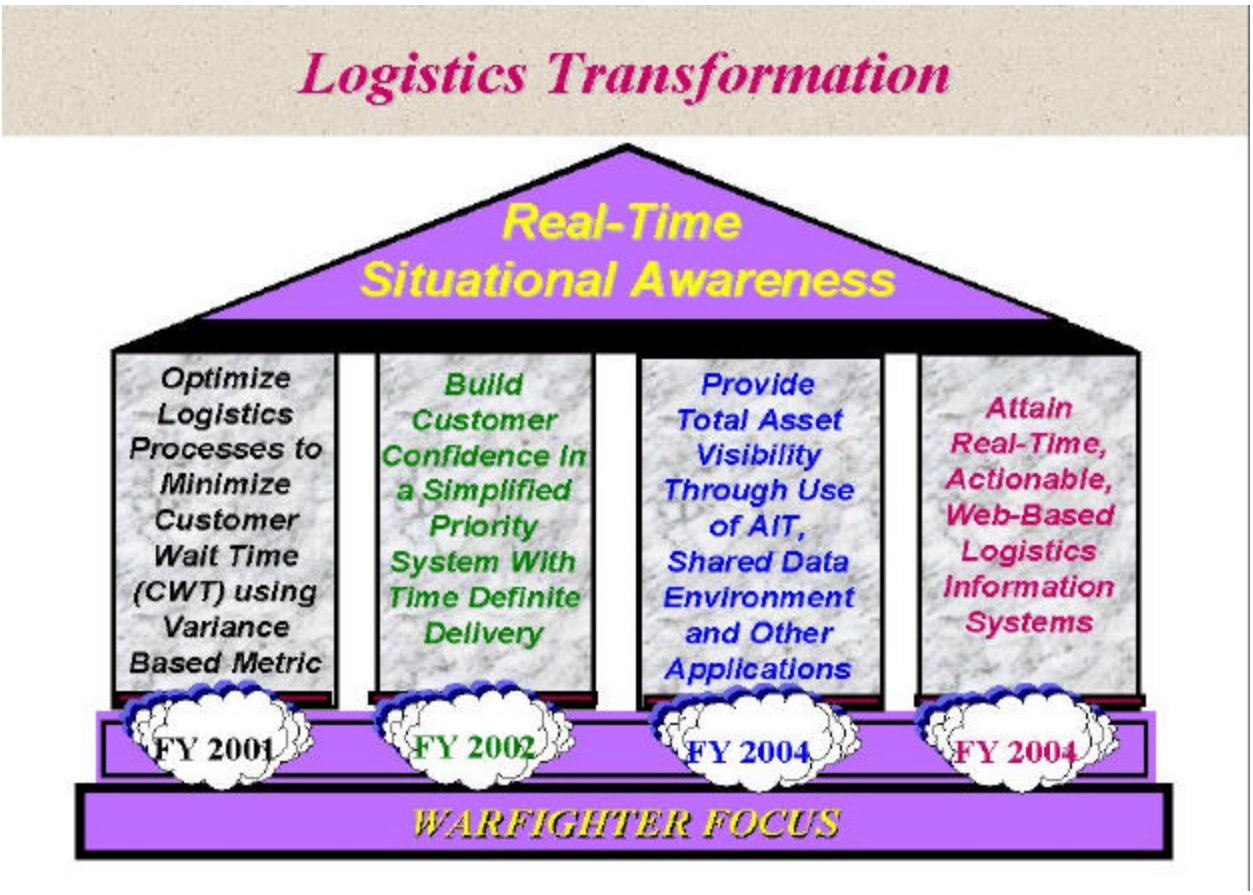

FIGURE 1: LOGISTICS TRANSFORMATION

Based on the goals of the DRID #54, the DoD has developed requirements for a Global Combat Support System (GCSS). DoD has also assembled background information for ongoing logistics improvement efforts, prepared initial design characteristics, prepared business process constructs by commodity class, coordinated preliminary design across all DoD stakeholders and begun holding technical interchange meetings between all of the Military Services, DLA, Combatant Commanders and Industry representatives.

GCSS DEVELOPMENT

The goal of the Global Combat Support System is to integrate logistics information across all logistics functional areas, combat support processes and the command and control (C2) processes to provide universal access to specific users of logistics information. Access is restricted to “need-to-know.” Since its primary purpose is to provide operational support to the war-fighter, GCSS will not process information in support of the various logistics processes, rather it will require access to the data that all DoD logistics processes produce. The logistics

support functional areas include “transportation, supply, maintenance, personnel, force/health protection, acquisition, finance and engineering.” [14] The scope of requirements for GCSS is focused on information interoperability between the DoD military “Services, Defense Agencies, commercial sector vendors, U.S. government agencies and non-governmental organizations (NGOs).”[15]

The six essential attributes of GCSS are: “1) any box, 2) any user, 3) one net, 4) one picture, 5) common services, and 6) a robust communications infrastructure.”[16] “Any box” refers to the ability to access information via any computer system, while “any user” refers to allowing access to all users across the area of operations. “One net” refers to the global command and control structure that is to be available across the area of operations and all logistics support functional areas. “One picture” requires that the same information be presented to all users in the same format so that all users will have the same look and feel. “Common services” are those basic computer services such as communication access across networks and printer services. “A robust communications infrastructure” will be required to alleviate communications bottlenecks and improve the efficiency with which data is processed from one node in a network to another.

COMPLEXITIES OF INTEGRATING NEW LOGISTICS SYSTEMS

As the DoD begins using commercially available software packages in attempts to cut systems development efforts, it compounds the issues involved with standard data by introducing additional data elements with different data definitions. In addition to the differences in data definitions, the DoD must also deal with interface issues with various systems processing logistics data. Application program interfaces (APIs) allow different application programs and or computer systems to exchange information. Figure 2 Illustrates the complexity of building APIs between disparate computer systems using different definitions for the data being exchanged.

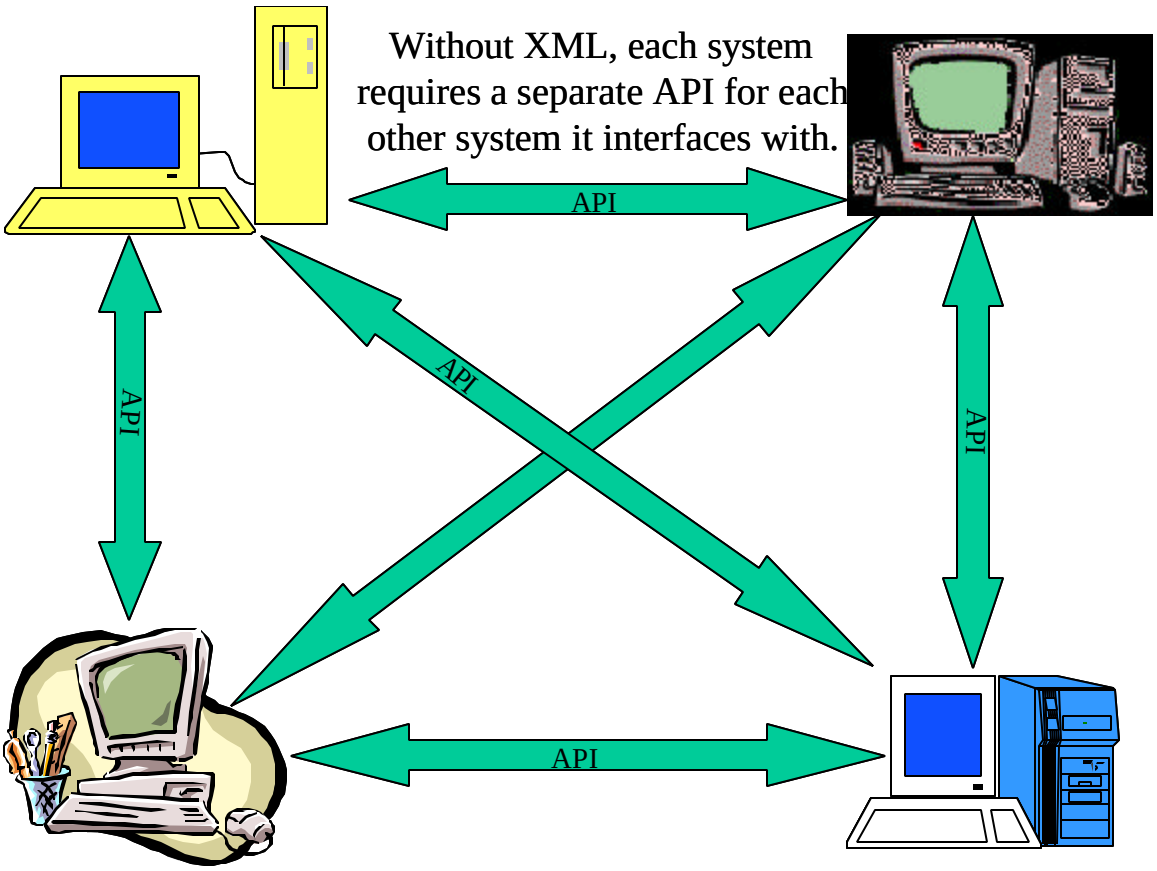

FIGURE 2: APPLICATION PROGRAM INTERFACES (API)

Every new application program or package that is introduced to operate with existing applications must have additional interfaces built to accommodate interoperability with the existing systems. Application program interfaces (APIs), map the data from one system to another so that the two systems for which an interface is developed can exchange data in the correct format. A new API must be built for each system that needs to exchange data with any new application that will operate within the systems architecture supporting the logistics functions within the DoD. Additionally, if one of the existing systems changes, new APIs must be developed to accommodate the changes between the systems. The constant API development process between changing computer systems helps to account for some of the "$1.5B and $2.5B that is spent annually to support thousands of logistics systems and their associated interfaces."[17]

Section 816 of the National Defense Authorization Act for Fiscal Year 1999 required the "Secretary of Defense, acting through the Secretaries of the military departments, to designate 10 weapon system programs to test program manager performance of product support

oversight responsibilities for life cycle support of acquisition programs."[18] This means that the contractor who is responsible for building a weapon system will now be given the responsibility to maintain that weapon system throughout its lifecycle. The contractor and the program manager for the weapon system will need access to existing legacy logistics systems in order to take advantage of existing standard parts that may be used within the development of the weapon system.

With the DoD program offices moving to contract out life cycle management of the weapon systems they are procuring, interfaces to even more applications and systems will be required to maintain a high level of information sharing. DoD logisticians will need to identify ways to make contractor life cycle support systems interoperable with new supply chain and existing DoD logistics systems. The use of a standard XML based data exchange for joint logistics information would enable the required exchanges of information and product development collaboration between government procurement offices and their respective contractors.

DEVELOPMENT CONSISTENT WITH JV2020

Joint Vision 2020 identifies information superiority and innovation as major tenets of full spectrum dominance. Information superiority allows a fighting force to achieve knowledge superiority, which in turn fosters decision superiority. Additionally the Joint Chiefs of Staff identify "innovation as a vital component of the transformation of the joint force."[19] The development of a DoD wide data exchange for logistics data would provide innovative avenues of interoperability to all DoD logistics systems that are not currently available through existing processes.

The GCSS being developed to provide operational support to the war-fighter could benefit from the enhanced interoperability that a common data exchange would provide, since the exchange would furnish a common set of data definitions and the context for using the information. Enhanced interoperability leads to information superiority. The information provided by XML based data exchanges are commonly referred to as intelligent data, since all of the information about the context, use and format are transmitted with the data. Intelligent data enhances interoperability between computer systems. JV2020 highlights interoperability as the foundation for effective joint operations. Within the logistics community the DoD could achieve information superiority by providing a greater degree of interoperability among the various existing logistics processes. Simultaneously, the DoD could also improve the ability to integrate new enterprise resource planning (ERP) systems with existing legacy architectures.

ENTERPRISE RESOURCE PLANNING (ERP)

Most of the Military Services are currently involved in the implementation of major ERP systems which will replace parts of their aging legacy supply chain management processes. ERP systems can integrate many functions across a Service's supply chain management process, including the requirements of finance, human resources, acquisition, warehousing and shipping. The ERP system replaces many of the individual computer applications and databases within the organization with a single system that enhances the overall performance of the organization's order fulfillment processes. Although most of the military Services will be using ERP solutions to replace a majority of the existing legacy supply chain systems, there will continue to be many existing logistics systems that the Services will need to maintain and interface with the new ERP systems.

Information superiority can be achieved when data from uniquely DoD and existing legacy supply chain systems exchange smoothly with newly installed ERP systems. This information superiority could be achieved with relatively low cost and the data exchange could leverage existing logistics standardization processes while providing less costly ways to integrate new technologies being fielded via the ERP systems development processes. A data exchange could blend new technological innovation and conceptual innovation into an imaginative recombination of old data standards with new computer-based processes to enhance DoD supply chain management processes.

USING XML FOR AN OPEN DATA EXCHANGE

Since the debut of the eXtensible Markup Language (XML) as an open data exchange language in 1998, it has been possible to allow manufacturers to exchange business information and define business processes that are independent of application program interfaces. XML enables different computer systems to exchange, interpret and act on data even when computer systems run on different hardware and are using different programming languages. In addition to the interoperability between two or more disparate computer systems, XML based data can be presented in a traditional Web page format. Any user who has been given access to the exchange and who has access to the Internet or Intranet through a standard personal computer and browser such as Navigator or Explorer can view and process the information being passed through the exchange.

The key to developing a successful XML based data exchange is the development of standard definitions for the data being represented. Data standards are difficult to develop and are even more difficult to agree upon. The many different entities involved in doing business

with each other all have their own idea of what data standards should be used to do business. The benefit of using XML is that the trading partners need only define one set of XML based data standards that represents the data that they want to use to do business with each other. The structure for describing data elements within XML is Document Type Definitions (DTDs). It is possible to further define DTDs with XML schemas.

The definitions executed in schemas can describe data types and the relations between data types. Because XML is extensible, new components can be added to existing schemas without affecting the existing computer system interfaces using the schema. System developers would have the option to incrementally change their existing systems to take advantage of any new components added to the data exchange. It is because of the XML schema definition flexibility that XML schemas have become an important tool for describing information structures of any kind. XML DTDs and XML schemas that represent a specific data structure for a specific business process or function can be "registered as XML specifications with the World Wide Web Consortium (W3C) or registered with the XML.org registry." [20] When a schema is registered in a public domain such as W3C and XML registry, it allows that structure to be used by other developers, who can then provide additional processes and services decreasing the costs associated with managing the information.

XML registries are available as a world wide central clearing house to allow developers and standards bodies to publicly submit, publish and exchange XML schemas, vocabularies and related documents. When a universe of data has been identified and the trading partners have agreed to the standard definitions, they must map their existing systems to an XML data exchange in order to provide interoperability. If a new trading partner wants to use this exchange, this new partner need only map their data and processes to the existing data exchange to be able to begin processing transactions with the other partners.

The extensibility of XML allows the addition of more data definitions to the existing data exchange. Any trading partner can take advantage of the new data definitions by making appropriate changes to their existing computer systems to use the additional data. The advantage of using this type of process rather than APIs is that no partner needs to change their current system processing or existing exchange mapping process when additional data is added to the data exchange. Figure 3 illustrates how a standard XML data exchange simplifies the interfaces between many disparate computer systems.

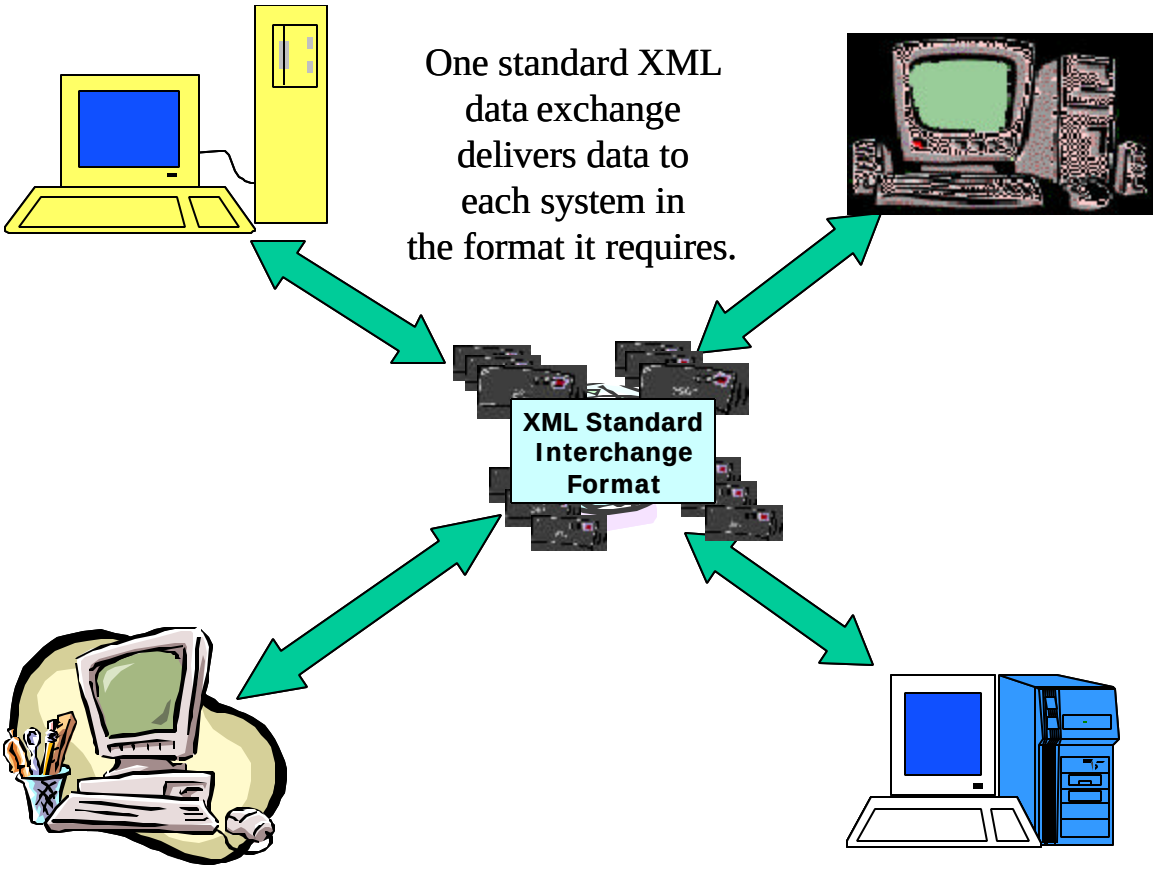

FIGURE 3: THE STANDARD XML DATA EXCHANGE

Only those partners who have a need for the additional information being offered and the means to change their existing systems processes need to make changes. The DoD Defense Information Systems Agency (DISA) has recently stood up the XML registry for the Defense Information Infrastructure (DII) Common Operating Environment (COE). The development of this registry provides a platform for enabling the standardization of DoD logistics data elements among the various military Services.

DISA'S XML REGISTRY

An XML registry is an important component of any online data exchange. The DISA registry provides support to system developers and integrators by establishing common lexicons and grammars for various functions within the DoD logistics processes and the DoD Common Operating Environment (COE). This registry enables the consistent use and reuse of XML based DTDs and schemas and contributes to the interoperability of those systems making use of the registry.[21] The registry provides a platform to allow DoD integration organizations to

search for existing XML data components and coordinate the development of new common XML data components.

Another element of service often provided by a data exchange is common data access services. Common data access services build XML based architectures to bridge between different data sources. A system "architecture can improve data sharing within the DoD COE and between the COE and non-COE systems."[22] DISA is currently developing a "common exchange table architecture, known as 'Garlic Fries', planned for incorporation in the 4.X series COE software."[23] This common architecture should improve access to the common data structures, within the COE.

THE CONCEPT OF AN XML BASED DATA EXCHANGE

The concept of developing an XML based data exchange is not a new concept. The Aerospace Industry Association has always had an interest in exploiting computer technology to enhance the ability of aircraft manufacturers to share information across their manufacturing processes. Recently, many aircraft industry manufacturers began using EXOSTAR to increase the amount of business they conduct over the Internet. "EXOSTAR in Herndon, Va. is an e-business service provider with an e-marketplace for the aerospace and defense industry."[24] The EXOSTAR marketplace is based on standard XML data definitions developed and agreed upon within a consortium of aerospace industry manufacturers.

Much the same as the aircraft industry, the automobile manufacturing industry has developed an automobile industry specific exchange called COVISINT. These exchanges can "transform disparate supply chain systems and methodologies among different buyers and sellers into a standardized platform that streamlines the e-procurement process."[25] In these two cases the major aircraft and automobile industry leaders "set the rules and standards that their suppliers must follow."[26] The smaller suppliers must follow the standards and map their automated systems to the established rules of those exchanges in order to do business with the buyers.

If industry organizations such as the Aerospace Industry Association and the American Automobile Manufacturers Association can work together to develop common XML based data exchanges to allow data sharing within their procurement and manufacturing processes, then the Department of Defense and its military Services could develop a common XML based logistics data exchange to allow data sharing across the Services' logistical support organizations. The development of eXtensible Mark-up Language (XML) technology has provided new processes for sharing information across various information technology

platforms. Because XML technology allows different systems to share information across the Internet via a data exchange without building Application Program Interfaces (APIs), the data sharing capabilities can be expanded to include additional systems or changes to existing systems without making changes to those systems that are currently mapped to the exchange.

CURRENT EB-XML EFFORTS

DLA and DISA currently share oversight of the Defense EBusiness exchange (DEBX), a relatively new XML data exchange designed to provide a single interface with commercial industry and DoD. The DEBX exchange automates "procurement and delivery of goods and services, along with purchase card transactions, travel arrangements and electronic fund transfers."[27] With the establishment of the DEBX exchange, some groundwork has already been accomplished in the development of a DoD wide logistics exchange. This automated exchange process is XML based and could be extended to include other logistics functions and processes. Additional work has also been accomplished through DoD's Defense Information Infrastructure (DII) working groups with the development of XML based schemas and models for processing product data information required to enable electronic requests for engineering support and electronic engineering change proposals (ECPs).

One of the first XML based pilot projects recommended by the DII working group was the Product Data Mark-up Language (PDML) project to automate engineering support requests (ESRs) that were managed via the DLA Form 339. DLA procures all consumable items for all of the Services and must identify specific product data required to support the Services' weapon systems. "Product data is an essential component of many procurement actions. In Item repair or reprocurement actions where product data is required, the technical data package must be assembled and then distributed to potential vendors." [28]

During the process of assembling a technical data package, DLA may require support from a Service's engineering department. At one time, requests for engineering support were submitted via hard copy forms called "DLA Form 339." The PDML project built an XML based process to integrate the processing of the electronic Form 339 between Defense Supply Center Richmond (DSC-R) and the following three Service inventory control points: the Naval Inventory Control Point (NAVICP), Mech., PA; the U.S. Army Tank Automotive and Armaments Command (TACOM), Warren, MI; and the Marine Corps Logistics Base (MCLB), Albany, GA. The PDML project leveraged on-going work and existing work to automate the Form 339 process. It demonstrated how an XML schema could be used to enable interoperability between several disparate computer systems within a Web-based environment.

The second project, the Joint Engineering Change Management Model (JECMM) project used lessons learned from the PDML project to push this type of technology even further by developing an XML based model of the data and processes required to initiate, process and approve an engineering change proposal (ECP) across commercial and various DoD computer systems. The strategy of the JECMM pilot project was to demonstrate that an open, standards-based, Web-based information exchange architecture could enable a near "plug-and-play" environment connecting "commercial off the shelf" (COTS), "government off the shelf" (GOTS) and legacy applications/systems and data repositories in a common engineering change management (ECM) process. The JECMM pilot project was built around a community of interest, a collection of DoD organizations that had a need to share product information within the ECM process. The JECMM pilot tested the ability of a small suite of XML web-based technologies to achieve interoperability between system engineering and logistics processes. With joint products or products with similarities across Military Services, sharing/exchanging information digitally between participating organizations in the different Services and DLA becomes critical to getting the desired product improvements to the user faster.

The JECMM pilot project specifically addressed the Configuration Management (CM) challenge of managing multiple configurations of the same weapon system by enabling the tracking of a great number of configurations, such as design configuration, pre-production configuration, as-built, as-maintained and as-modified. CM is a large and very important process for managing products, such as DoD weapon systems, over their life cycle. CM is typically divided up into the three sub-process areas: Configuration planning and management, Engineering change management and Configuration status accounting and audit.

The ECM process is the most dynamic part of the CM process and is most often the driver for product configuration changes. The ECM process is applicable throughout the product life cycle, especially since it is often the case that engineering change proposals need to be evaluated against earlier baselines that may include "as designed." "As designed" refers to the way a piece of equipment was designed to function in a weapon system prior to any engineering changes. The ECM challenge is even greater for joint products or weapon systems, especially in the coordination of proposed changes and the exchange of information related to the proposed changes. The JECMM pilot project explored the capability of a proposed open, standards-based technology to provide a robust XML based information exchange capability between the Services and DLA.

CONCLUSION

One of the common problems with many acquisition programs is much of the technical data required for operating and maintaining a weapon system does not continue to flow to field offices after systems are fielded. Therefore, critical operating and maintenance information may not be distributed to people who need it. Many acquisition programs are most concerned with getting products out to their user customer base. Although technical data is usually available with the products, it can be out of date, not received with the product, or if it is received, it is in hard copy format or an electronic format that is not easily updated or transmitted to the field in a timely manner. With the use of a logistics data exchange, product information could be made available as it is required and as it becomes available. Manufacturers could share new product information, future engineering changes, technical document updates and product safety notices. All of this information is valuable both in the field and for the re-procurement, maintenance and repair processes.

Future logistics processes must provide combatant commanders the opportunity to act on timely information. The speed and operational tempo envisioned for future combat systems will not afford future logistics systems the luxury of having a lot of time to mass the materials in order to sustain battlefield operations. Therefore future logistics processes will need to work smarter and faster with much less mass and higher velocities of material in order to get the right material, at the right place, at the right time. Smarter and faster logistics systems will require a higher degree of interoperability and flexibility.

As demonstrated by the many projects that are either in development or have recently been implemented, the use of XML based data exchanges can be a powerful tool for enabling integration among many different computer systems. To date, there has been no DoD strategic plan or focus to coordinate XML development efforts and existing data standards in order to identify a common logistics data exchange across the DoD. By cross-referencing and augmenting the existing logistics data definitions in the DISA XML registry with the standard definitions within GCSS and other joint systems, the DoD could begin managing the myriad of logistics data definitions and begin developing a standard joint logistics data exchange. There are many challenges that must be overcome in order to move the DoD to a joint logistics data exchange.

First, there are the challenges of coming to a common understanding across the Services of what standard data definitions should be used to enable each system to appropriately understand the information that is being shared. Much of this work has already been accomplished in one form or another. This is the logical data and process modeling aspect of

using and sharing data based on its intended meaning. To overcome this challenge a DoD working group could be established to review existing standards and make recommendations for the definitions that need to be housed in the joint exchange.

Second, there are challenges related to the physical connectivity and networking of the systems involved in an exchange. The development of connectivity between the Services, DLA and commercial entities requires negotiation and the development of some standards to allow passage of information through firewalls and gateways. The developers must determine what message transport services, adapters and integration tools to use and what business process rules will be used to govern the transporting and routing of information.

The physical concerns of connecting software systems in a global environment across all of the Services and DLA primarily involve the software protocols and tools that link together their various applications and enable them to exchange messages. These protocols and tools are the system adapters and transport mechanisms that connect legacy software to the data repositories and warehouses that contain information about the many different weapon systems managed by the DoD. DISA would be the logical choice for managing physical connectivity between the Services, industry vendors and a joint logistics data exchange, since it has the responsibility of maintaining most of those data warehouses and repositories.

In contrast to the physical connectivity, the logical data concerns involve understanding what the data in one military Service system actually means in that system and how it relates to each of the other DoD systems and vendor systems. Addressing these semantic concerns involves discovering how information is used differently by each of the Service systems and how that information maps to the common or standard view. Currently, most semantic interoperability issues are handled by either a common, group vocabulary of terms such as EDI and/or custom-coded, point-to-point bridges that translate how one particular vocabulary is supposed to relate to the group's vocabulary or another Service's vocabulary.

Further logistic system integrations could include integrating the standard DoD joint logistics data exchange to some of the industry trading portals such as EXOSTAR and COVISINT. This would require negotiations with and agreement of trading portal members. The successful development of common data exchanges within private industries provides ample examples for the DoD to emulate and verifies that this type of development effort can provide great benefit while also holding down the cost of reengineering existing systems. A standard joint logistics data exchange within the Department of Defense would provide interoperability among existing DoD systems and industry partners while allowing the DoD to begin moving toward the incremental development of standard systems and processes.

Interoperability is cited as a requirement in Joint Vision 2020. "Interoperability is the foundation of effective joint, multinational, and interagency operations."[29] A standard XML based data exchange for joint logistics information would not only support this requirement but also enable collaboration between the Services and their industry partners. Existing private industry exchanges have already proven that this type of data exchange can dramatically improve interoperability. The DoD has already invested resources to standardize data for logistics processes. The existing DoD standards could be used in conjunction with industry standards to build a data exchange for use by all DoD logistics based systems.

All changes to both the exchange and the systems supported by the exchange could be developed incrementally, thus spreading the cost of those changes across time. The toughest problem associated with building a joint logistics data exchange would be the requirement to identify and coordinate all existing legacy data standards and systems that would benefit from the development effort. A common data exchange could eventually lead to a complete standard system for processing and accessing logistical data within the DoD.

The development of a standard joint logistics data exchange would support the DII COE concept, readiness, integrated logistics and logistics interoperability. The exchange would also enhance commanders' logistics decision-making processes and enable incremental process changes supporting attainment of improved logistics performance. A standard data exchange would allow sharing of data as a corporate asset across DoD and promote assimilation of existing and future logistics applications.

Integrating related processes, tools, systems and capabilities into a broader logistics process exchange will improve data quality by reducing the need to reenter data because the same data in a standard format, such as XML, can be reused by many applications. Also if the primary source of data is more accessible, such as over the Internet/Intranet, then there is less of a need to replicate the data locally. A standard XML based data exchange for Joint Logistics Information would allow the sharing of information and collaboration between buyers, maintainers, designers, vendors, engineers and users. It could be developed in stages and grow from past and current standardization efforts and provide an efficient means to support the war-fighter in the field.

RECOMMENDATIONS

The DoD should begin development of a standard XML based data exchange for logistics support. The DISA XML registry should be used as the DoD data standards repository for all XML components describing logistics data. The standard logistics data definitions within GCSS

should be used as a starting point to augment existing data element definitions in the DISA XML registry. Application interfaces for logistics systems currently in use should be replaced by mapping them to the new standard XML based data exchange. Additionally, any new interfaces required between existing systems should use the exchange to provide information between computer systems that currently do not have that capability. Since DISA has the responsibility of maintaining many of DoD's data warehouses and repositories and has already developed the XML registry for the DII COE, DISA should be designated to manage physical connectivity between the Services, industry vendors and a joint logistics data exchange. DISA should determine what message transport services, adapters and integration tools to use and what business process rules will be used to govern the transporting and routing of information. The rules should be consistent with current DII COE architecture requirements and should be published for use by DoD developers.

A DoD working group should be established to review existing standards such as the EDI standards, GCSS standardization efforts, DAASC MILS based standards, the DISA repository of XML components, XML based EDI components and any other existing DoD data standards. The working group should identify how information is used differently by each of the Service systems and how that information maps to the common or standard view. After the review the working group should identify and make recommendations for the definitions to be housed in a standard joint data exchange. The working group should negotiate with private industry exchange groups such as EXOSTAR and COVISINT to become trading portal partners to integrate the standard DoD joint logistics data exchange to some of the industry trading portals.

Word Count 7,121

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